Bently's Corner

Synchronous impedance plots record machine performance

Bently Nevada has encouraged customers for several years to document machinery performance by utilizing polar and Bode' plots. This has been taught in our seminars and has been asserted in our publications. We have provided the required transducers, the readout devices, and diagnostic instruments to steer our customers in the proper direction in spite of heavy overemphasis on "spectrum analysis" by our competitors.

These synchronous graphs of machinery performance provide extremely vital information and historical documentation. They are documents of dynamic motions, however. And because dynamic motion is the result of dynamic force divided by dynamic impedance, there is an automatic ambiguity of motion expression.

For example, on a machine where 4 mils peak-to-peak is the alert level, a 5 mil peak-to-peak motion could be either an excessive input force or insufficient impedance (such as excessive bearing clearance). In fact, it could be the result of both conditions occuring simultaneously.

In the Calibration Weight Balancing process, a weight is added of a known amount at a known radius, angle, and lateral position. The effect of the weight is then observed as a motion vector at one speed by all vibration transducers on the machine. The result of this test has historically been called the "influence coefficient." Actually, it is the impedance of the rotor system *at that particular speed with the test imbalance applied.*

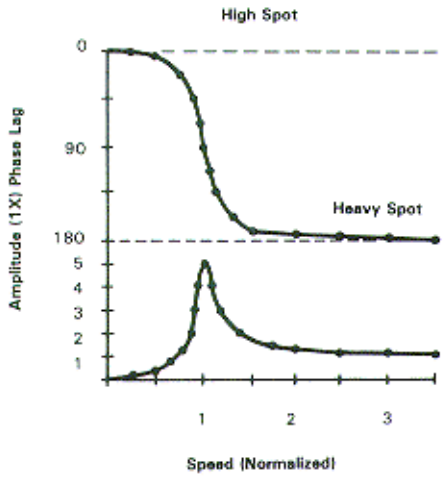
Synchronous Speed Impedance Plots are simply the same impedance as noted above except that the data is taken for the *entire speed range.* These impedance plots may be done as (1) amplitude and phase or (2) as direct and quadrature components. I prefer the latter.

It is important to note that while these Synchronous Impedance Plots provide important information and historical documentation, they do not serve as indicators of rotor stability. Another test, called Nonsynchronous Impedance by Perturbation, is required for stability indicators.

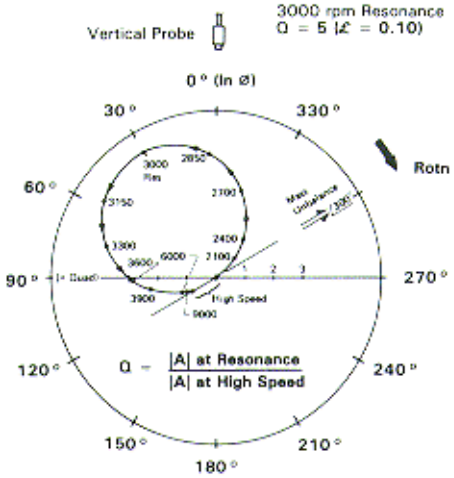
The ADRE® system is readily adapted to run Synchronous Impedance Plots and the Smart Monitor® with a host processor is also capable of producing this data.

By Don Bently

Bode' Plot



Polar Plot



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